Temporary Manual 170-178
6-12-61

EXECUTIVE MODEL 100

Citizens Bander Operation Manual

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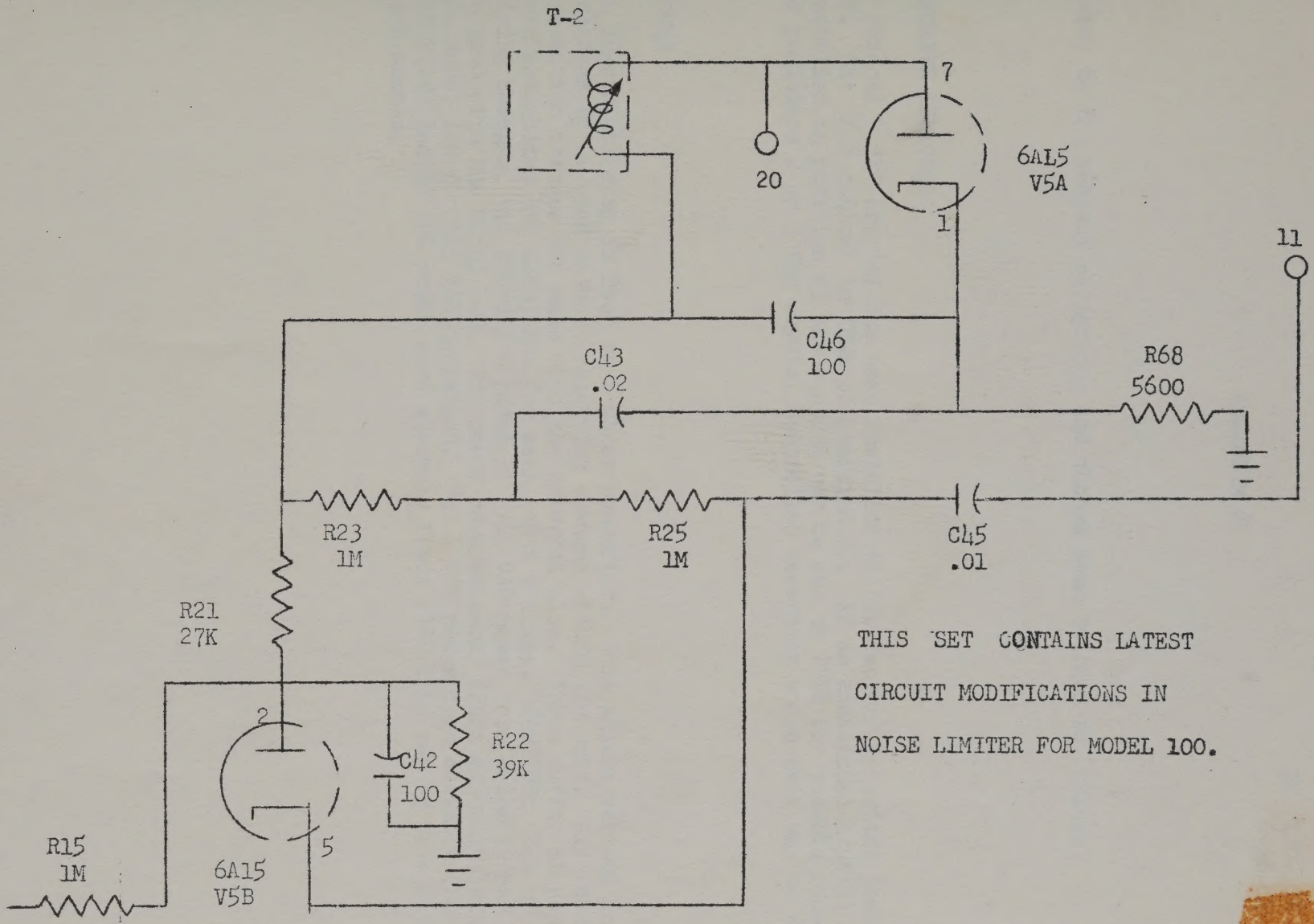
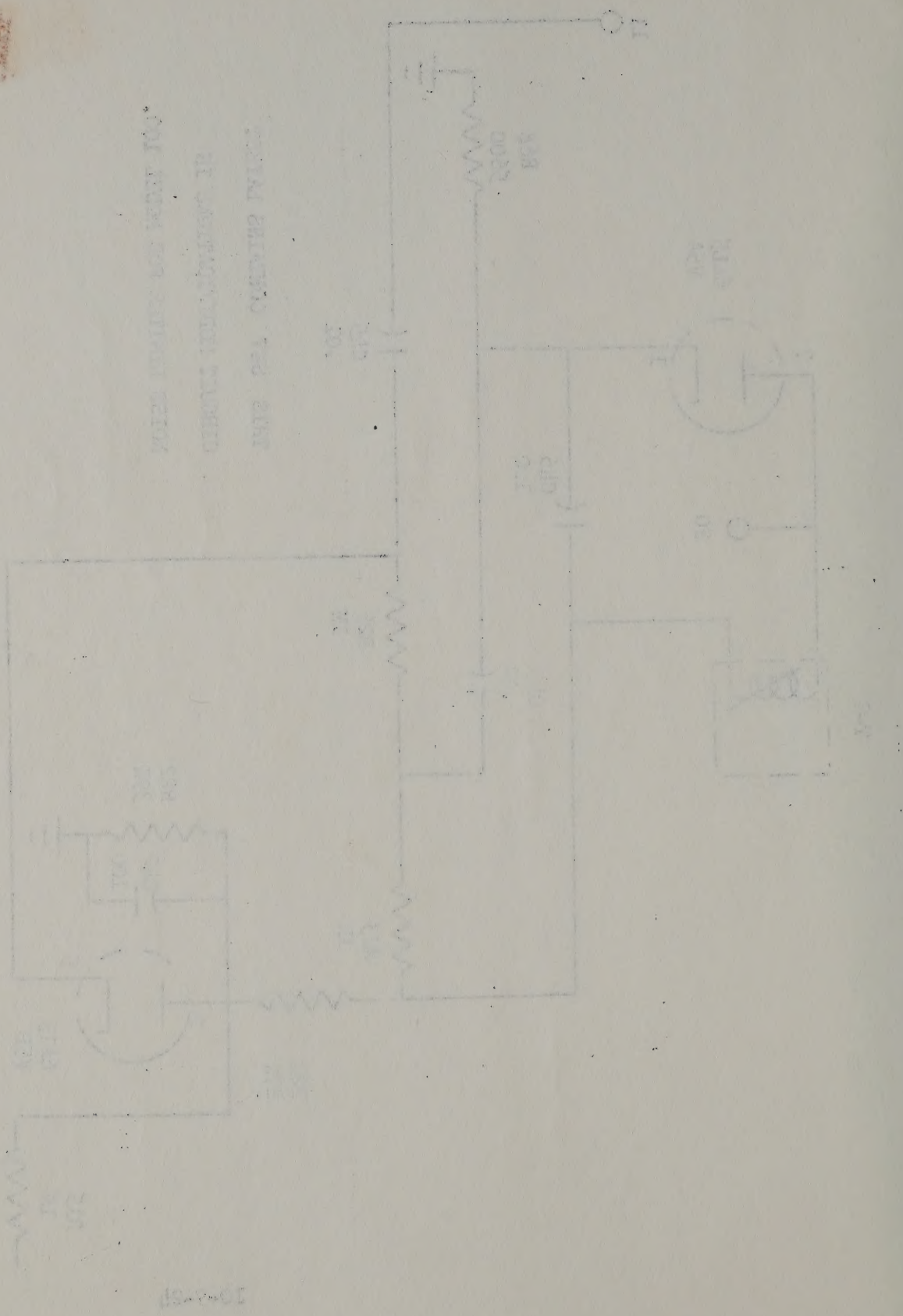
I N T E R N A T I O N A L
Crystal Mfg. Co., Inc.
18 N. Lee
Oklahoma City, Oklahoma



10-9-24

THIS SET CONTAINS LATEST CIRCUIT MODIFICATIONS IN NOISE LIMITER FOR MODEL 100.



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ADDENDUM #1

Refer to the subject paragraphs and change same to read as follows:

RECEIVE SELECTOR

A Channel 9 "R" crystal has been installed at the factory in switch position #2. Set this control to TUNE or position #2. If an additional crystal is installed in position #3 the control may be set to TUNE for tunable reception or positions 2 or 3 for crystal controlled reception which ever may be desired.

POWER

An 18-contact plug is used as a power connector. This allows various input voltages to be used without requiring changes within the unit. All necessary connection changes are made with the external plug. Three different power cord assemblies are used, one for each input voltage. CAUTION: Due to wiring changes, the Executive Model 50 115 VAC power cord assembly can not be used with the Model 100. Use power cord assembly (Part #150-174) with the Model 100 for 115 VAC operation. The 6 VDC power cord assembly (Part #150-118) and 12 VDC power cord assembly (Part #150-119) may be used with both models.

SECTION I

GENERAL

The INTERNATIONAL EXECUTIVE, Model 100, is a Citizens Band unit which combines sensitive and super selective, dual conversion superhetrodyne receiver, with a highly stable and efficient, crystal controlled transmitter. The complete transmitter, receiver and power supply are housed in an attractive, brown and silver colored cabinet, to blend favorably in the home, office, car or truck.

The EXECUTIVE Model 100 receiver is the first commercially available citizen band unit to make use of a high-frequency crystal filter to achieve and permanently guarantee receiver selectivity for the life of the equipment. Use of this filter between the first and second mixers greatly reduces adjacent channel interference and offers a very flat response throughout the band-pass of the filter.

The receiver manually tunes all 23 Class "D" Citizens Band channels. In addition, two receiving crystal sockets are provided in the unit, for the selection of any two desired channels. The selection of either crystal controlled channel, or manual tuning, is accomplished with a three-position switch on the front panel. A squelch circuit is built-in, to provide receiver quieting during periods when no signal is being received.

The transmitter oscillator uses fundamental crystals, operating at one-half the desired operating frequency. The crystals supplied have a frequency tolerance of ± .005% when used in the EXECUTIVE. A twelve position crystal switch assembly allows the operator to choose anyone of twelve channels at the flick of the switch.

The EXECUTIVE has been designed with flexibility of installation in mind. It may be used in the home or office, with power secured from the ac line. It may also be used in a car, boat, plane or ther mobile and portable applications, wherever there is 6 or 12 dc available. It may be used with a base loaded whip antenna, regular whip, long wire, ground plane, beam and other types of antennas. The attractive case design lends itself to use in the home or office without appearing unsightly or out of place.

Though the unit is very versatile, it is not to be expected that either receiving or transmitting results will be the same in every installation. As in all radio communications and particularly in VHF applications, the type of antenna, its location above ground, the noise present in the area and other factors are bound to affect the results obtained.

SPECIFICATIONS

Receiver:

Tuning Range (Manual tuning)	26.955 to 27.235 mc, (Class "D" Citizens Band, Channels 1 through 23).
Tuning Range (Selector Pos.2)	Crystal Controlled - Any Channel, 1 through 23.
Tuning Range (Selector Pos.3)	Crystal Controlled - Any Channel, 1 through 23.

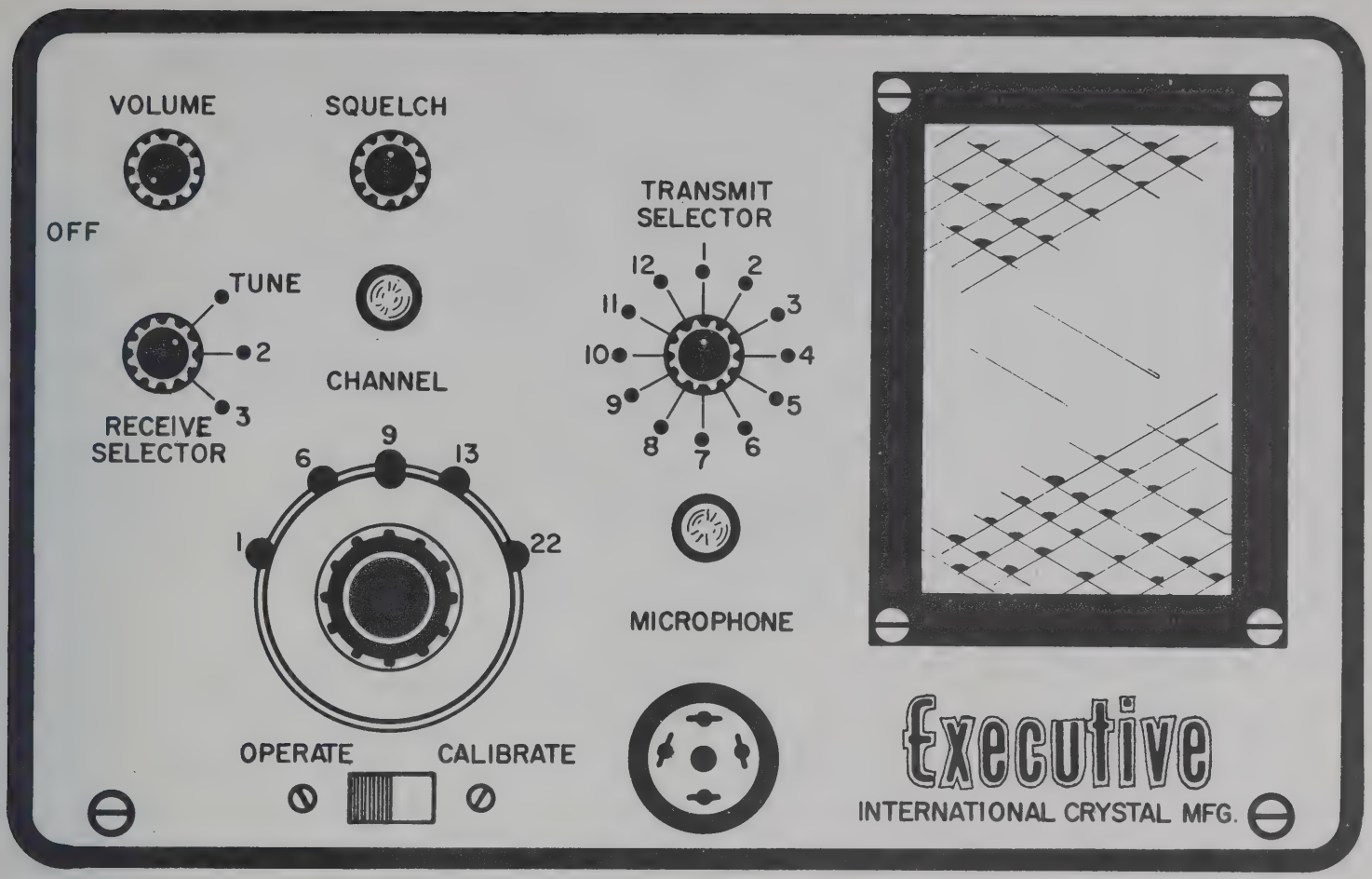
Sensitivity	Usable to .5 microvolts
Selectivity	50 db down at 10 kc better than 60 db down at 20 kc
Image Rejection	Better than 50 db down
Audio Output	2.5 watts into 4-6 ohms
Speaker Impedance	4-6 ohms
Squelch Range	1 To 50,000 microvolts. On-off differential is approximately 1 microvolt, at 5 microvolt input.
Noise Limiter	Automatic, series-gate

TRANSMITTER

Frequency Stability	± .005% @ 0° to 125° F, when used with INTERNATIONAL high stability fundamental crystals.
RF Power Input	5 watts maximum (FCC rules)
Modulation	Capability - 100%
Crystals Required	Transmitter - International "T" (T-9 for Channel 9, etc.), high stability, fundamental type, at one-half the desired frequency. Receiver - International "R" (R-9 for Channel 9, etc.)
Microphone	High impedance crystal, ceramic or high output dynamic type. (Push-to-talk switch required.)

POWER CONSUMPTION

Transmitting	65 watts (approximately)
Receiving	60 watts (approximately)
Weight	12 pounds (approximately)



FRONT PANEL CONTROLS

VOLUME

On-off switch, volume control. To turn receiver on, turn the knob clockwise. Clockwise rotation of the knob also increases the volume level.
Allow the set to warm up for about one minute before you wish to use it.

SQUELCH

This control is used to eliminate background noise when no signal is being received. Upon initial warmup, turn this control fully counter clockwise until a click is heard. The switch in the squelch control is **off** in this position. To operate, turn squelch control on and fully clockwise. Then slowly turn the control counterclockwise until the background noise just disappears. Leave the control set at this point. Do not turn the control too far counterclockwise as this will reduce the receiver performance and weak signals will not be heard.

RECEIVE SELECTOR

Set this control to TUNE unless receiver crystals have been installed in positions #2 and #3, in which case set the switch to the desired crystal position for crystal controlled reception.

TRANSMIT SELECTOR

A channel 9 crystal has been installed at the factory in switch position #2. Place the switch in this position unless you have had other crystals installed, in which case select the channel on which you desire to transmit.

CHANNEL (Tuning)

With the RECEIVE SELECTOR set in TUNE position this control tunes the receiver through the range of all 23 channels. The approximate locations of channels 1, 6, 9, 13 and 22 are indicated on the panel. Other channels fall in between these points.

OPERATE-CALIBRATE (Switch)

During normal operation this switch is left in the OPERATE position. When it is desired to pretune the receiver to a specific Channel (you must have a transmit crystal for this channel installed in the Transmit Selector crystal socket) set the controls as follows:

TRANSMIT SELECTOR to the desired channel.
OPERATE-CALIBRATE switch to Calibrate.
SQUELCH CONTROL full counterclockwise to click **Off.**
RECEIVE SELECTOR to Tune.
Rotate tuning dial until the loudest part of the tone signal is received. Rock the tuning dial back and forth to locate the center of the signal. Leave tuning dial at this point and the receiver is pretuned to transmit channel you have selected.

MICROPHONE (Receptacle)

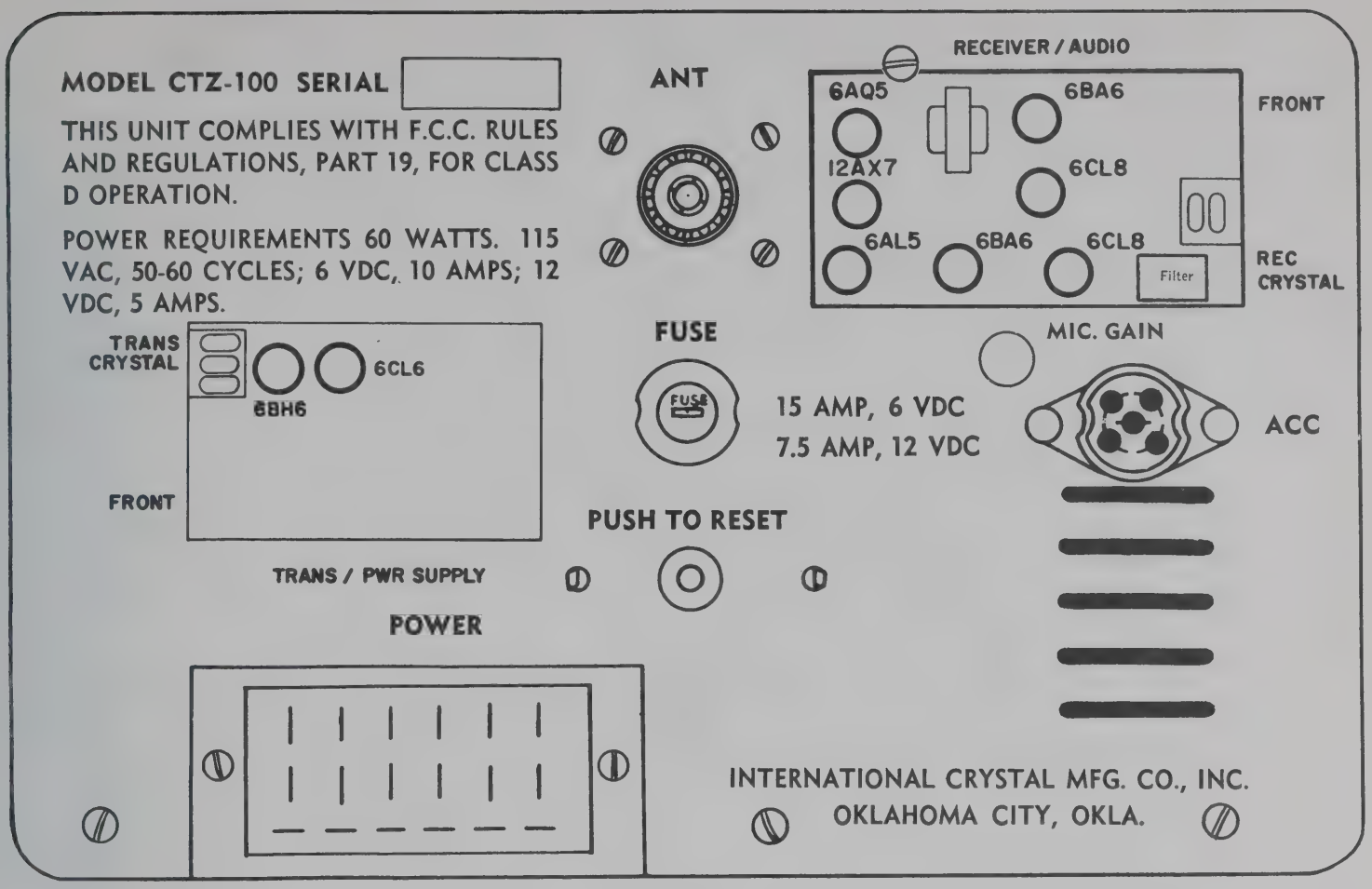
This connector requires a four prong lock-on plug which is furnished with the unit. High impedance crystal or ceramic type microphones may be used with this transceiver.

RECEIVE (Indicator)

This indicator, located directly below the squelch control, functions as an ON-OFF (plate voltage) indicator for the receiver section of the transceiver. When the transceiver is operating in RECEIVE position, the lamp will glow steadily and go out when the transceiver is placed in TRANSMIT position.

TRANSMIT (Indicator)

This indicator functions as an audio level monitor. Depress the microphone keying button and speak directly into microphone. The indicator light will flicker intermittently as you speak in a normal voice level. With indicator operating on voice peaks, modulation will be about 95%. When talking too close to microphone the indicator lamp will glow almost constantly. This can result in overmodulation and cause adjacent channel interference. This indicator will flicker when the transceiver is in RECEIVE position also, showing proper operation of the receiver audio section.



REAR PANEL CONTROLS

ANT (Antenna Receptacle)

This receptacle is used to connect the transceiver line to the transmit-receive relay, TR-1. The receptacle is a standard low-loss, VHF type designed for 50- to 72-ohm coaxial cable.

ACC (Accessory Receptacle)

This connector requires a five prong plug which is furnished with the unit. This plug contains a jumper for internal speaker operation and must be in place for the set to function. An external speaker and Signal Strength ("S") Meter may be connected to this set with this connector.

FUSE

A 15 ampere fuse is installed in the fuseholder and may be changed or replaced, if necessary, by unscrewing the red insert in the center of the holder. If the transceiver is to be operated on 12 volts dc the fuse should be replaced with one having a rating of 7.5 amperes.

MIC. GAIN (Microphone Level)

This control (yellow knob) adjusts microphone amplifier gain. The level has been factory set for close microphone operation. For base station operation, where the operator desires to talk several inches back from the microphone, this control may be turned clockwise until the red Transmit Indicator lamp flashes on voice peaks.
CAUTION: Excessive gain will cause overmodulation.

PUSH TO RESET

This is a thermal cut-out. It protects the unit when it is being operated on 115 volts ac. If overload causes it to cut out, it can be reset by pressing in on the plunger and holding it in for about two seconds.

POWER

An 18-contact plug is used as a power connector. This allows various input voltages to be used without requiring changes within the unit. All necessary connection changes are made on the external plug. Three different power cord assemblies are used, one for each input voltage. CAUTION: The 115 VAC Power Cord for the Executive Model 100 and Model 50 are wired differently. Use only the proper power cord for the Model 100—Part Number 150-174.

SECTION II

RECEIVER CIRCUIT DESCRIPTION

A complete block diagram of the transceiver is shown on page 9.

The receiver section of this transceiver is a double conversion unit employing the superheterodyne principle of frequency conversion. The first converter is composed of three basic sections; an rf amplifier, mixer, and oscillator which is either tunable or crystal controlled.

A received signal from the antenna is coupled to the control grid of the rf amplifier through a double tuned circuit consisting of coils L1 and L2, their respective shunting capacitors, and coupling capacitor C3. This double tuned circuit aids greatly in the elimination of unwanted signals outside the passband to which it has been tuned. The gain of the rf amplifier is controlled automatically by the receiver's AVC system coupled to the control grid of V1 through a 1 megohm resistor.

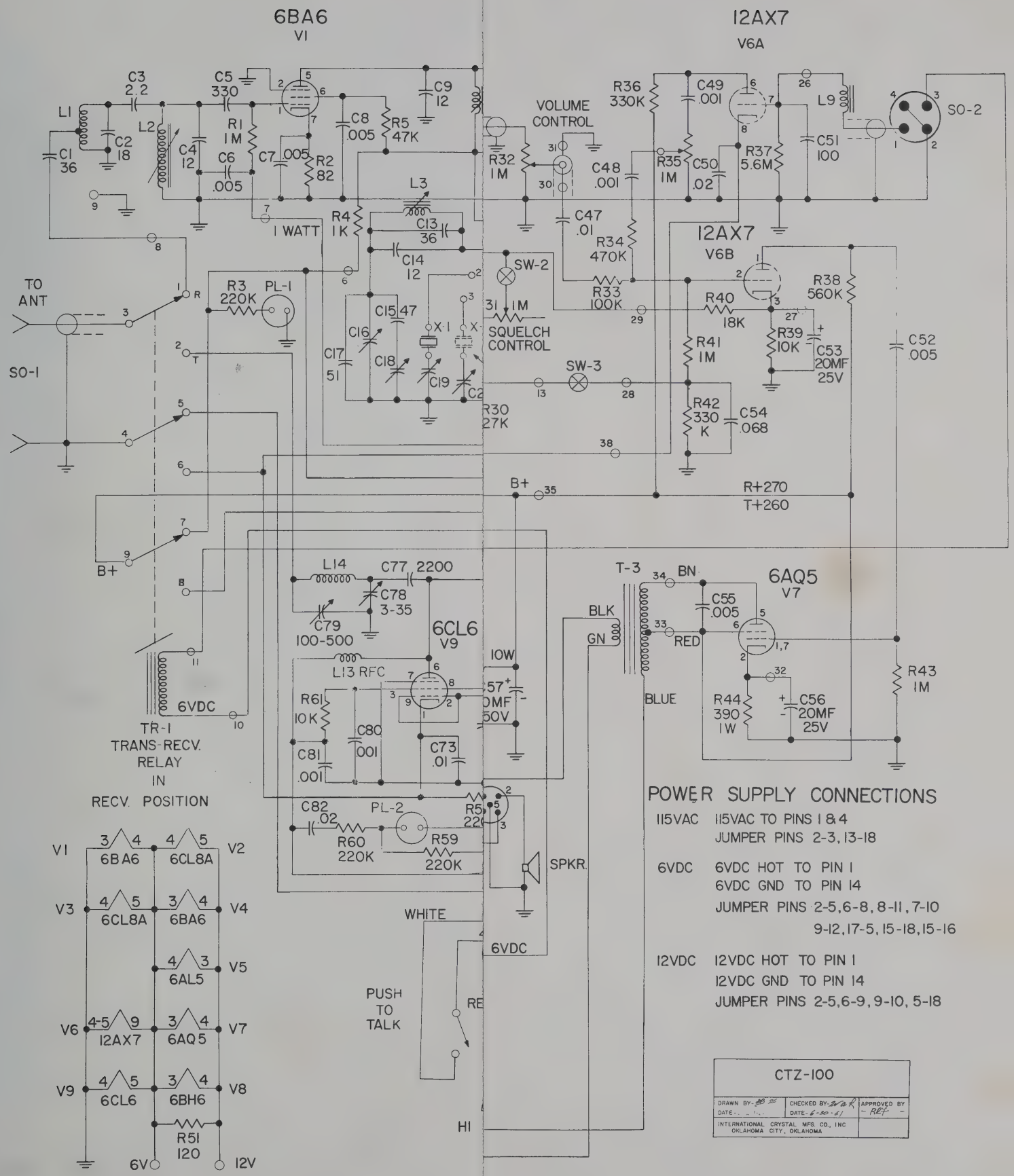
After reaching the control grid of V1 (6BA6) the signal is amplified and coupled to the control grid of the mixer, V2A (triode section of 6CL8A). Here the signal is heterodyned with a signal in the 17 mc region coupled from the oscillator, V2B (tetrode section of 6CL8A). A difference frequency signal at 10 mc is selected by coil L4 in the plate circuit of the mixer, V2A and coupled to the grid of the second mixer in the I.F. strip through the 10 mc crystal amplifier-filter assembly.

The oscillator is a conventional Colpitts circuit which may be either crystal controlled or tuned over a limited frequency range when the RE-RECEIVE SELECTOR switch is in TUNE position.

The second section of the receiver consists of a mixer and crystal controlled oscillator, intermediate frequency amplifier, second detector and noise limiter, and a special squelch circuit.

The 10 mc signal received at the grid of the second mixer, V3A, is heterodyned with a 10455 kc signal from the crystal controlled oscillator, V3B. The difference frequency of 455 kc is selected in the plate, circuit of V3A and transformer coupled to the control grid of the intermediate frequency amplifier, V4. The gain of this amplifier is also automatically controlled by the AVC system connected to the grid of V4 through the secondary of transformer, T1 and 220 K ohm resistor.

The signal is further amplified in V4 and coupled from the plate through transformer, T2 to the plate of the detector, V5A, where the audio component is dectected. V5A is also used to produce the AVC voltage. The detected signal is coupled to V5B which acts as a series-type noise limiter removing noise pulses which may ride through on the signal. The squelch circuit consisting of a neon lamp, NE-1 silicon diode, CR-1 and associated components is connected so that the audio section of the receiver is cut off and background noise eliminated when no signal is being received. The cut-off level may be varied by use of the squelch control.



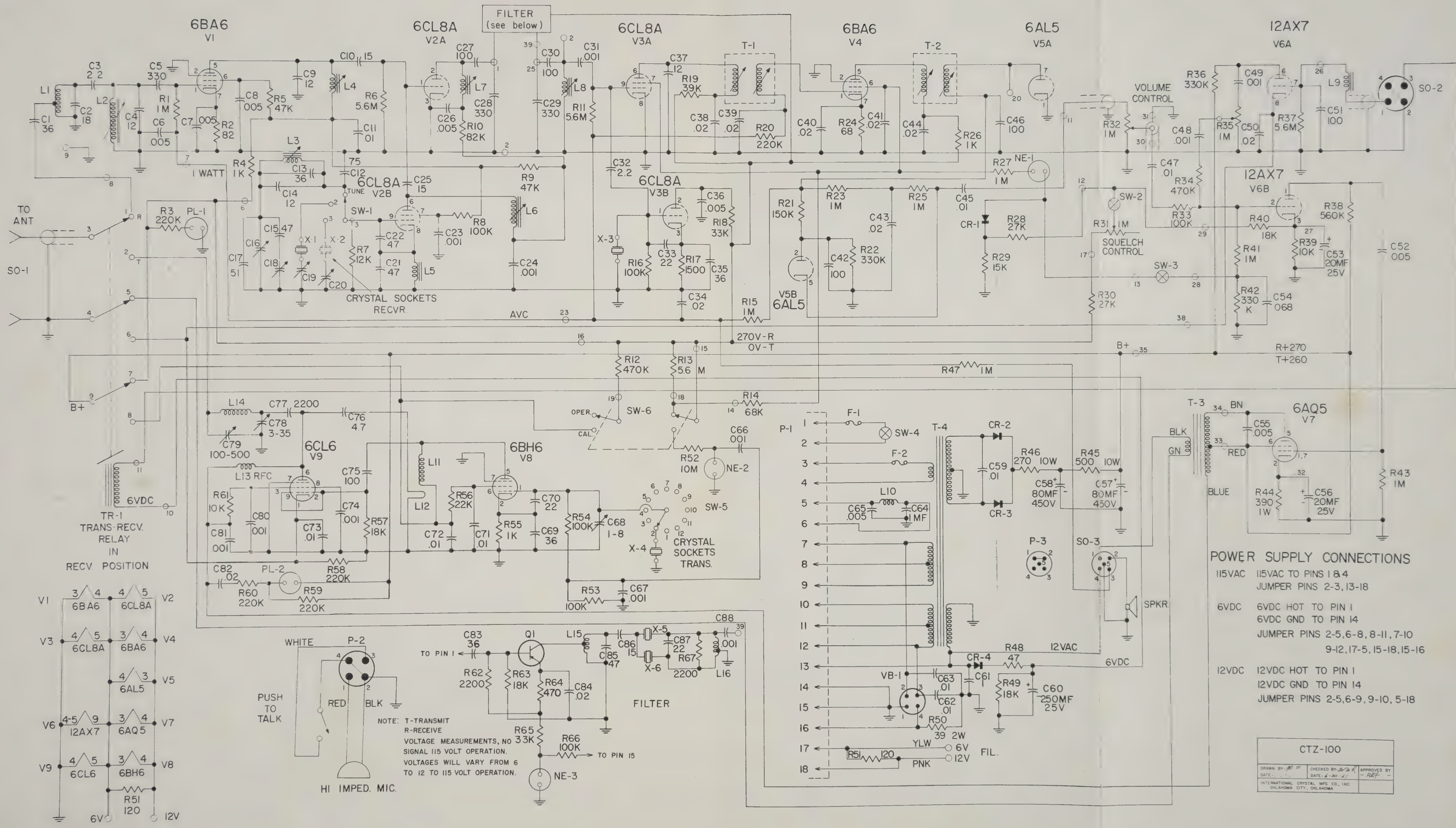
POWER SUPPLY CONNECTIONS

115VAC — 115VAC TO PINS 1 & 4
JUMPER PINS 2-3, 13-18

6VDC — 6VDC HOT TO PIN 1
6VDC GND TO PIN 14
JUMPER PINS 2-5, 6-8, 8-11, 7-10
9-12, 17-5, 15-18, 15-16

12VDC — 12VDC HOT TO PIN 1
12VDC GND TO PIN 14
JUMPER PINS 2-5, 6-9, 9-10, 5-18

CTZ-100		
DRAWN BY- DATE-	CHECKED BY- DATE- 6-20-61	APPROVED BY - RBF -
INTERNATIONAL CRYSTAL MFG. CO., INC OKLAHOMA CITY, OKLAHOMA		


6BA6 V1
6CL8A V2A
FILTER (see below)
6CL8A V3A
6BA6 V4
6AL5 V5A
12AX7 V6A
12AX7 V6B
6CL8A V2B
6CL8A V3B
6AL5 V5B
6CL6 V9
6BH6 V8
6AQ5 V7
VOLUME CONTROL
SQUELCH CONTROL
CRYSTAL SOCKETS RECVR.
CRYSTAL SOCKETS TRANS.
TO ANT
SO-1
SO-2
SO-3
SO-4
P-1
P-2
P-3
PL-1
PL-2
NE-1
NE-2
NE-3
SW-1
SW-2
SW-3
SW-4
SW-5
SW-6
CR-1
CR-2
CR-3
CR-4
X-1
X-2
X-3
X-4
X-5
X-6
T-1
T-2
T-3
T-4
VB-1
F-1
F-2
TUNE
OPER
CAL
AVC
270V-R
0V-T
B+
R+270
T+260
12VAC
6VDC
SPKR
FIL.
1 WATT
PUSH TO TALK
WHITE
RED
BLK
BLUE
BN
GN
YLW
PNK
HI IMPED. MIC.
FILTER
TO PIN 1
TO PIN 15
L1 36
L2
C1 36
C2 18
C3 2.2
C4 12
C5 330
C6 005
C7 005
C8 005
C9 12
C10 15
C11 01
C12 75
C13 36
C14 12
C15 47
C16
C17 51
C18
C19
C20
C21 47
C22 47
C23 001
C24 001
C25 15
C26 005
C27 100
C28 330
C29 330
C30 100
C31 001
C32 2.2
C33 22
C34 02
C35 36
C36 005
C37 12
C38 02
C39 02
C40 02
C41 02
C42 100
C43 02
C44 02
C45 01
C46 100
C47 01
C48 001
C49 001
C50 02
C51 100
C52 005
C53 20MF 25V
C54 068
C55 005
C56 20MF 25V
C57 80MF 450V
C58 80MF 450V
C59 01
C60 250MF 25V
C61
C62 01
C63 01
C64 1MF
C65 005
C66 001
C67 001
C68 1-8
C69 36
C70 22
C71 01
C72 01
C73 01
C74 001
C75 100
C76 47
C77 2200
C78 3-35
C79 100-500
C80 001
C81 001
C82 02
C83 36
C84 02
C85 47
C86 15
C87 22
C88 001
R1 1M
R2 82
R3 220K
R4 1K
R5 47K
R6 5.6M
R7 12K
R8 100K
R9 47K
R10 82K
R11 5.6M
R12 470K
R13 5.6 M
R14 68K
R15 1M
R16 100K
R17 1500
R18 33K
R19 39K
R20 220K
R21 150K
R22 330K
R23 1M
R24 68
R25 1M
R26 1K
R27 1M
R28 27K
R29 15K
R30 27K
R31 1M
R32 1M
R33 100K
R34 470K
R35 1M
R36 330K
R37 5.6M
R38 560K
R39 10K
R40 18K
R41 1M
R42 330 K
R43 1M
R44 390 1W
R45 500 10W
R46 270 10W
R47 1M
R48 47
R49 18K
R50 39 2W
R51 120
R52 10M
R53 100K
R54 100K
R55 1K
R56 22K
R57 18K
R58 220K
R59 220K
R60 220K
R61 10K
L3 .000
L4
L5
L6
L7
L8
L9
L10
L11
L12
L13 RFC
L14
L15
L16
Q1
6VDC
TR-1 TRANS-RECV. RELAY IN RECV POSITION
V1 6BA6
V2 6CL8A
V3 6CL8A
V4 6BA6
V5 6AL5
V6 12AX7
V7 6AQ5
V8 6BH6
V9 6CL6
6V
12V
NOTE: T-TRANSMIT R-RECEIVE
VOLTAGE MEASUREMENTS, NO SIGNAL 115 VOLT OPERATION.
VOLTAGES WILL VARY FROM 6 TO 12 TO 115 VOLT OPERATION.
POWER SUPPLY CONNECTIONS
115VAC 115VAC TO PINS 1 & 4
JUMPER PINS 2-3, 13-18
6VDC 6VDC HOT TO PIN 1
6VDC GND TO PIN 14
JUMPER PINS 2-5, 6-8, 8-11, 7-10
9-12, 17-5, 15-18, 15-16
12VDC 12VDC HOT TO PIN 1
12VDC GND TO PIN 14
JUMPER PINS 2-5, 6-9, 9-10, 5-18
CTZ-100
DRAWN BY-
DATE-
CHECKED BY-
DATE- 6-20-61
APPROVED BY
INTERNATIONAL CRYSTAL MFG CO., INC.
OKLAHOMA CITY, OKLAHOMA

The third section of the receiver is a conventional audio amplifier consisting of a twin triode audio voltage amplifier, (12AX7) V6A-V6B followed by a 6AQ5 (V7) tetrode power amplifier. When the transceiver is in RECEIVE position only one half of the 12AX7 is used. The second triode section V6B receives the audio signal from the center tap of the volume control. The audio signal is amplified in V6B whose output is RC coupled to the control grid of the power amplifier, V7. The audio signal is further amplified in V7. The plate of V7 is connected to transformer, T-3, which performs a dual function. In RECEIVE position this transformer acts as a normal output transformer with its secondary connected to the speaker. In TRANSIT position, its function is that of a modulation transformer.

CAUTION: Other than adjustment of the receive crystal trimmers, alignment of the Executive Model 100 receiver should not be attempted without proper sweep generator and oscilloscope equipment. If receive crystals are added to the Executive Model 100 after the unit leaves the factory, the crystal trimmer capacitor connected to the socket where the new crystal is to be installed should be adjusted as follows:

1. RECEIVE SELECTOR set to position where the new crystal is to be installed.
2. SQUELCH CONTROL set fully counterclockwise to click off.
3. VOLUME CONTROL half open.

Both crystal trimmers are adjusted at the factory, consequently will require only minor adjustment to correct the oscillator for reception on the desired crystal controlled channel. Connect the probe of a VTVM to pin 3 on the accessory socket and the meter ground lead to the chassis of the Executive Model 100. Set the meter for negative voltage measurement on the 5 volt scale.

Connect the output of a signal generator of known accuracy such as the International C-12B Frequency Meter thru the PK-Box to the antenna connector on the Executive Model 100. Set the frequency meter to the desired channel and function switch to RF. Depress the PWR switch to On. Using an insulated alignment tool, carefully adjust the crystal trimmer capacitor for maximum AVC voltage as indicated by the VTVM.

TRANSMITTER CIRCUIT DESCRIPTION

The transmitter is a two-stage unit consisting of a crystal controlled oscillator and neutralized tetrode final amplifier. The crystal oscillator is an electron-coupled Colpitts circuit with the crystal oscillating in the grid-cathode circuit. The oscillator uses International high stability, fundamental type crystals operating at one-half the desired transmitter output frequency. A twelve position switch, TRANSMIT SELECTOR,is provided to select any one of twelve crystals, which may be installed within the unit. A channel 9 crystal is furnished with the unit and installed in one of the twelve crystal sockets.

The plate circuit of the oscillator is tuned to the second harmonic of the crystal frequency by coil L12. The oscillator output is coupled to the grid of final amplifier, V9, through capacitor C70. The plate circuit of V9 is a shunt-fed, pi matching network. Neutralization is accomplished by capacitor C71, and link coil L12, coupled to the cold end of coil L11.

NOTE: Capacitor C63, which is a small plastic tubular capacitor should not be adjusted, except by a technician with a commerical F.C.C. license, as this adjustment can effect the frequency of the transmitter.

POWER SUPPLY CIRCUIT DESCRIPTION

A three-way power supply is used in this transceiver. It operates as a conventional, full-wave rectifier circuit on all voltage inputs followed by a capacitor input RC filter network. On 6 or 12 volt battery operation, a vibrator circuit is used to provide the necessary ac voltage for the primary circuit of the power transformer.

The transceiver is supplied with a power cord for operation from 115 volts ac, 60 cycles. The unit may be operated either from 6 volts or 12 volts dc by use of the proper power cord assembly which may be purchased from your dealer. The power supply is equipped with a thermal circuit breaker for protection on ac operation. For protection on 12 volt dc operation a 7.5 ampere fuse is used with the transceiver. Protection on 6 volt dc operation is provided by a 15 ampere fuse which is supplied with the unit. When 12 volt dc operation is desired the 7.5 ampere fuse must be substituted for the 15 ampere fuse.

CAUTION: Due to wiring changes, the Executive Model 50 115 VAC power cord assembly can not be used with the Model 100. Use power cord assembly (Part #150-174) with the Model 100 for 115 VAC operation. The 6 VDC power cord assembly (Part #150-118) and 12 VDC power cord assembly (Part #150-119) may be used with both models.

TRANSMIT-RECEIVE RELAY CIRCUIT DESCRIPTION

By including a transmit-receive relay (TR-1) in this transceiver, the many advantages of "push-to-talk" operation and maximum transfer of energy to and from the antenna are afforded the operator at no extra cost. The circuit consists of a half-wave rectifier which receives its ac voltage from a 12 volt secondary winding on the power transformer. The rectifier is followed by an RC filter network whose output is connected in series with one end of the relay coil. The other end of the relay coil is connected through the microphone socket, to the switch in the microphone. The relay is actuated by depressing the microphone switch button. This completes the 12 volt dc relay circuit to ground and the relay performs the following switching functions:

RECEIVE - In this position the relay is not energized and the antenna is connected to the receiver input, B+ voltages are furnished to the receiver section and one side of the speaker is grounded.

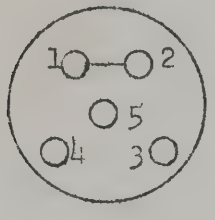
TRANSMIT - The relay is energized and the antenna is switched to the transmitter output circuit, B+ voltages are furnished to the oscillator screen and plate circuits as well as V6A. The speaker voice coil is removed from ground and the cathodes of V6A and V9 are grounded.

ACCESSORY RECEPTACLE (ACC)

This connector, located on the rear panel of the unit, requires a five prong plug which is furnished with the unit. This plug contains a jumper for internal speaker operation and must be in place for the set to function. For external speaker (4 to 6 ohms) operation, remove the jumper and connect the external speaker between terminals 1 and 5 of the plug.

Also available at terminal #3 of this connector is the negative AVC voltage produced by the second detector of the I.F. unit. This voltage may be used to operate an "S" Meter provided the input impedance of the external meter is one megohm or more.

Accessory Plug Wiring

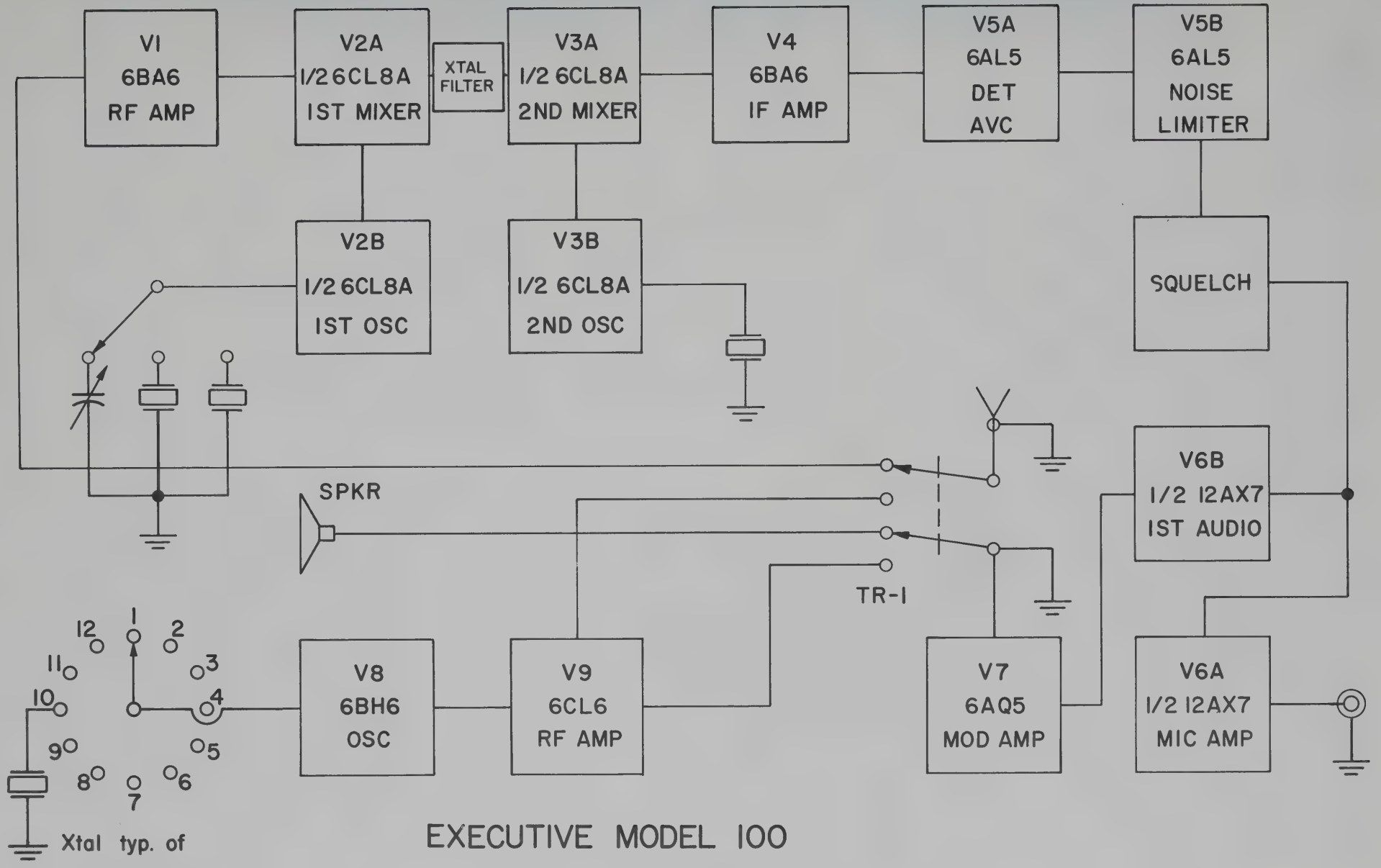


1, 2 } Jumper

3 -AVC Voltage

4 12 VAC

5 Ground



EXECUTIVE MODEL 100
BLOCK DIAGRAM

ANTENNAE AND THEIR SELECTION

By R. R. FREELAND, International Crystal Mfg. Co. 10W0382/10W0326

The most common antennae for citizen use are the Ground Plane and Coaxial for base use and the Vertical Whip for mobile use. The Yagi multi-element beam antenna can be used to great advantage where point-to-point communication is required rather than non-directional coverage from the base station. Any antenna with a directional gain will effectively increase the radiated power of the transmitter as well as the received signal applied to the receiver.

It is best to purchase a good commercially built antenna rather than attempt to construct your own. Good commercial antennae have low SWR (standing wave ratio) which is a merit of the radiation efficiency. With home constructed antennae it is sometimes difficult to effect a good match between the antenna and the transmitter causing considerable power to be lost in the system. An antenna should have an SWR of no more than 2:1.

Some power will be lost in the transmission line and therefore long runs should use the larger RG-8U cable. This cable has a lower loss per foot than the smaller RG-58/U. Both types have a characteristic impedance of 53 ohms. Loss per 100 feet at 27 megacycles is 1 db for RG-8/U and 2 db for RG-58/U. For short runs the RG-58/U cable is more easily handled.

Most of the antennae are available in two grades. The lower priced standard grade will not be as mechanically strong as the commercial grade. Electrically both grades are usually about equal. Where ice loads, wind, and salt air are a factor it will be cheaper in the long run to purchase the better antenna.

For extremely short range communication (less than a mile) the base loaded case whip antenna works very well. With two units using case whips, the signals will become quite weak after a block or two and poor squelch operation will be encountered. The outside antenna is by far the best choice and should be mounted as high as practical and still be within F.C.C. regulations. [Paragraph 19.25(c)]. In brief, the F.C.C. limits antenna height to no more than 20 feet above an existing structure or not to extend above the top of the radiating element on an existing tower. Remember the Yagi type antenna is usually mounted in a horizontal position. This type antenna must be used with another antenna mounted in the same plane. If the Yagi is to be used to communicate with mobile units using a whip antenna, the Yagi should be mounted in a vertical plane. A little thought in antenna installation will greatly improve your coverage.

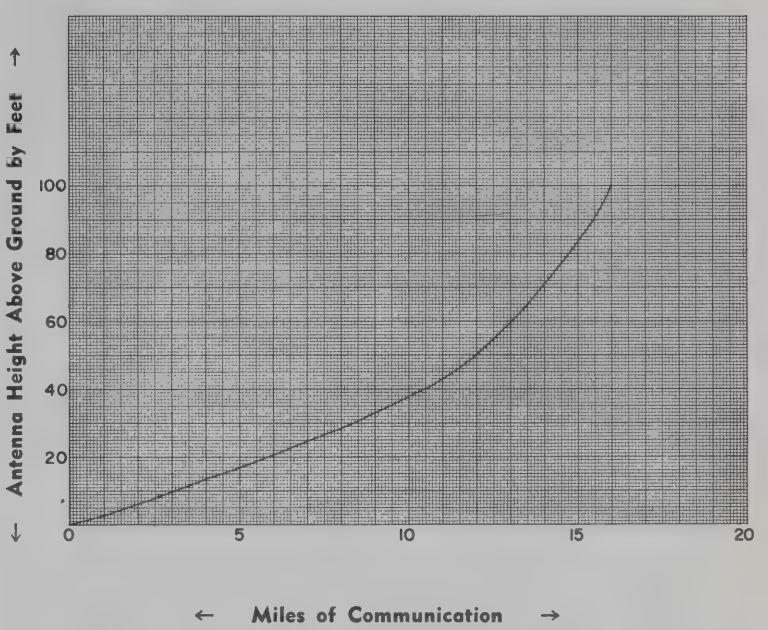
DISTANCE vs ANTENNA

The direct coverage you are able to obtain using Citizen Equipment in the 27 megacycle band will depend a great deal upon the antenna. We shall speak of direct coverage rather than skywave coverage wherein you may communicate 500 to 2000 miles at various times.

The F.C.C. has intended the Citizen use to be for short range communication and all installations should be calculated on this basis. The following charts consider a base station antenna mounted on a mast with the calculated range to a mobile unit using a standard 108" whip. Remember that the antenna may be mounted on an existing structure or mast [reference F.C.C. 19.24(c)].

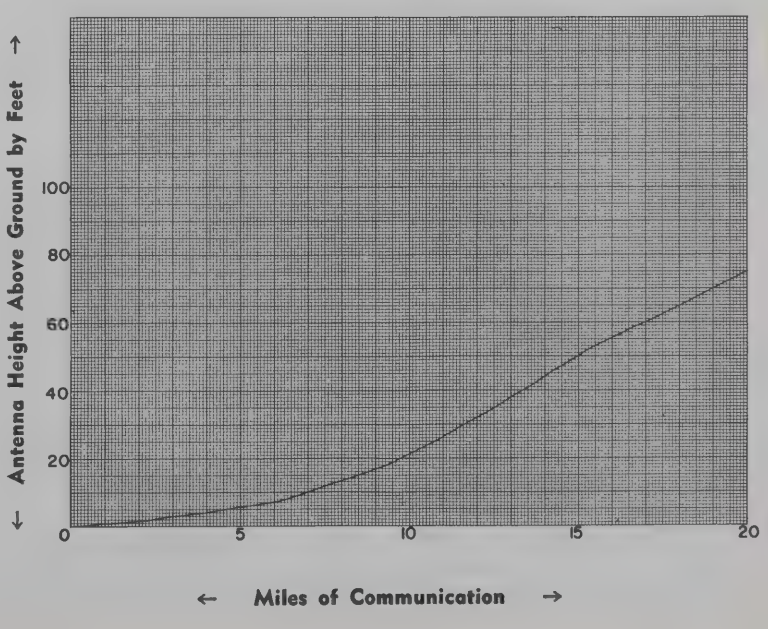
Ground Plane or Coax Antenna For 2 Microvolts at Receiver

Chart #1



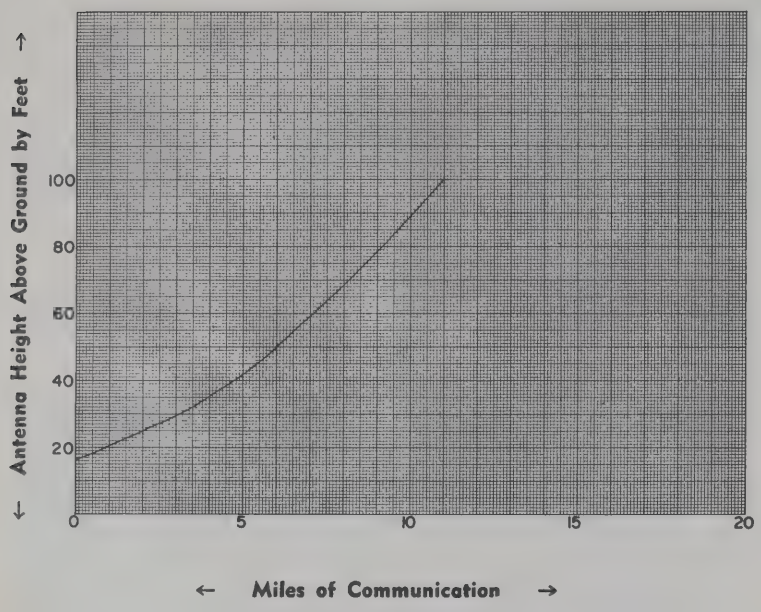
Yagi Antenna Mounted Vertical For 2 Microvolts at Receiver

Chart #2



Ground Plane or Coax Antenna For 15 Microvolts at Receiver

Chart #3



Note how the distance increases with increase height of the antenna for a given installation as in Chart 1. If a direction antenna is used as in Chart 2 you can see how the distance is further increased, however, this reduces the area covered since the Yagi Antenna is quite directional.

Charts 1 and 2 are based on a 2 microvolt signal at the receiver. This signal will not be sufficient for many city areas where high levels of noise exist. Chart 3 considers the coverage for 15 microvolts at the receiver and is more practical for general city use.

When the Citizen frequencies are open to skywave transmission, signals from distant stations will be strong enough to over power weak direct signals. When one is considering communication he should understand that for 100% contact he should base the calculations on 15 microvolts or more.

In mobile communication dead spots will be found at various points as well as locations giving excellent signals. These points should be noted and contacts made from the best possible locations. Vehicle noise and electrical interference will greatly reduce your communicating distance.

ELIMINATE YOUR MOBILE "NOISE GENERATORS"

By GEORGE L. BEYERS, 10W0376

Now that low cost TWO-WAY radio communication is available to everyone with the opening of the eleven meter band for Citizen use the number of mobile installations will probably exceed the number of base, or control, stations by a factor of 5 to 1 within the near future. It is estimated there are now over 160,000 citizen band mobile installations and approximately 45,000 base, or control, stations in operation. Proper installation and necessary steps towards the elimination of electrical, and mechanical, interference inherent in all motor vehicles is of prime importance if distances of three miles or more are desired to be covered.

For short range coverage the simple installation of a "radio condenser" on the generator and the "interference suppressor" installed in the top of the distributor, or coil, is usually sufficient noise suppression. But when maximum distances of three or more miles must be covered, great pains must be taken and all known means of noise suppression must be used. Different makes and models of vehicles will require different means of noise suppression. Some models only the very simple, others will need the "all out" method.

As there are numerous "generators" of radio interference in every motor vehicle the elimination of one source may not be noticeable as it's noise level may be below one you have not located so the proper way to approach your "noise" problem is by a systematic process of first suppressing all known offenders, namely the generator, voltage regulator, distributor and spark plugs.

We will explain throughout this article what is considered to be the proper vehicle noise suppression methods. The volume of noise you can, or will, tolerate in your receiver will depend upon the amount of suppression applied. Few installations will require the "all out" method and the user must decide when he is satisfied.

The purpose for eliminating your own "noise generators" is the fact that your receiver's automatic volume control (AVC) will react to these random noise pulses the same as though a strong station was tuned-in and will cut the receiver's sensitivity way down which will eliminate the weak stations you normally wish to copy. There's an old saying "if you can't hear them, you can't work them."

Let's start our "noise elimination" with the generator and voltage regulator. The generator is the item that causes the whine as the speed of the motor is increased. It is very easily detected by speeding up the engine and then cutting the ignition off. The instant the switch is turned off ONLY the generator and voltage regulator can cause the noise as all other "noise generators" are eliminated when the switch is off EXCEPT the generator as it is still in operation and is still trying to charge the battery through the voltage regulator. Even though it will operate only a few seconds after the switch is off this is time enough for you to hear the terrific amount of noise it is generating. As the speed of the engine decreases the whine will decrease in unison.

Practically all vehicle manufacturers cable the two leads from the voltage regulator to the generator in a harness with other wires. It is recommended that both of these wires be run in **separate** tinned copper braid. Just disconnect the present wires from the generator and the other end of them at the voltage regulator's "A" and "F" terminals. They can be cut-off where they enter the harness or just taped down out of the way.

A Sprague 48P18 coaxial capacitor, or a similar .5 mfd coaxial capacitor, should be installed directly ON the generator and the lead from the condenser to the battery armature terminal of the generator must be as short as possible. In fact a length of one inch is sometimes too long. A .001 mfd mica capacitor should now be installed from the same battery terminal to the frame of the generator, here again lead length is extremely important and they should be no longer than one-quarter inch. Be sure to remove paint and grease on the generator where the capacitor is bolted as a "good" ground at this point is necessary.

Dress the cable from the coaxial capacitor on the generator against the body of the car. Use speed clips to keep in place or run through presently installed cable clamps. This cable is usually the longest "noise generator" we must suppress and it is preferred to shield this wire in tinned copper braid. The end of the braid must be soldered directly to the coaxial capacitor's body. Be sure to use size #12 copper stranded wire when making-up this new lead. Connect a new cable to the generators' "F" (field) terminal and run this lead in a tinned copper braid shield and dress it along side the battery lead. This new lead may be of size #16 copper stranded wire.

The voltage regulator is next and the "job" from here on is usually easy compared to the one just completed. Remove the cover from the voltage regulator and clean off any paint that may insulate the cover from the frame. Check the mounting screws and be sure the regulator is being grounded directly to the firewall. If necessary remove and clean away any paint so you may secure a "perfect" ground connection.

Use two 48P3 of 48P5 Sprague coaxial capacitors or similar .1 to .5 mfd coaxial capacitors and install at the "A" and "B" terminals of the regulator. The capacitors metal body must be grounded directly to the firewall. This can be easily accomplished by using a piece of cadimun plated metal about 4" x 4" bent to a 90° angle. Drill two holes for the capacitors and two holes to pass sheet metal screws to bolt to the firewall. Attach the capacitors to the angle with screws and nuts and **also** solder. Locate the assembly so the lead from each capacitor to the "A" and "B" regulator terminals are extremely short. Be sure to clean the paint from the firewall so the bracket will make a good solid ground connection. Attach the cable from the generator's "F" terminal to the voltage regulator's "F" terminal. Connect a .002 mfd capacitor and a 4 ohm resistor, in series, from this point to ground. Again, lead length is important and the overall length of the capacitor-resistor combination must be as short as possible. Attach the lead from the generator's armature terminal to the coaxial capacitor connected to the voltage regulator's "A" terminal. The shielding braid on these leads must be grounded to the capacitor bracket or to the firewall by soldering or with the use of washers and sheet metal screws. Attach the "B" battery lead to the coaxial capacitor connected to the "B" terminal of the voltage regulator. This is the lead coming through the firewall and usually goes direct to the battery charging indicator on the vehicles dash panel.

The next superb "noise generators" of them all are the spark plugs. But here we have available to us years of research for only a few dollars. Just go to your local auto supply store and purchase a complete set of AUTO-LITE RESISTOR spark plugs that are direct replacements for your particular brand and model of vehicle. CAUTION: We own no stock in Auto-Lite, but please accept no "substitute" as some **resistor** plugs will actually increase your noise problem. Be patient, if your dealer does not stock your size just ask him to get them for you. When installing the new plugs be sure to have the gap properly set.

After **properly** installing the "recommended" suppression to these trouble makers you should be able to drive comfortably and communicate with stations you never heard before with your engine running. However, in most cases this is only the beginning of the job in order for you to say that you have a good mobile installation.

If you have been checking your "noise elimination" progress as you complete each step we know you will be extremely pleased with your work. But from here on each suppression job will not be very noticeable until you hit the one big joker that's causing a lot of trouble. The little "noise generators" will be obscured by this one and wouldn't have showed up until it was eliminated. All-in-all the little ones can really add up and must be taken care of in due time.

Have your distributor checked to see that the capacitor across the breaker points has the proper capacitance and the points are properly set. If the vehicle has been driven 30,000 to 40,000 miles or more it is recommended that the distributor cap and rotor be replaced. This will usually not only reduce the ignition noise, but also improve the overall performance of the engine. At the same time have the timing checked and properly adjusted.

When purchasing your new AUTO-LITE resistor spark plugs also buy enough 4,000 ohm-per-foot ignition cable to make up a new wiring harness from the distributor to the spark plugs. Be sure that the new terminals (ferrules) are installed whereby they make **good** contact with the center conductor of the new cable. It is preferred that the ferrules be soldered rather than crimped on as there is danger of a poor contact causing another "noise genertor" to appear.

Check your ignition wiring by shorting out each plug, in turn, while listening to the receiver. Any reduction in the noise level will usually indicate that the ferrules are not making good contact in the distributor head, or the ferrule and center conductor should be soldered.

Install a 10,000 ohm carbon suppressor in the distributor's center terminal and make up a new lead to run to the coil. Here again be sure the ferrules are soldered and are making a "tight" connection inside the coil and distributor. A new lead is recommended here as any breaks what-so-ever in the ignition system's wiring insulation could be a source of "ignition noise." With very short leads connect a .001 mfd disc ceramic capacitor from the coil's battery terminal to the coil's case.

Bonding braid should now be run from the fire wall, coil, and the distributor to the engine. Use as short a piece of braid as possible in each case. If the ground lead of the battery is attached to the fire wall it should be removed and attached to the starter mounting bolt. The power cable ground lead for your transceiver should also be connected at this same point. Usually the hot and ground leads from the battery go direct to the starter's

solenoid which is mounted on the starter and this is a good place to connect the transceiver's power cable. CAUTION: Remove the hot cable from the battery before making connections to the starter as there is danger of the hot battery cable getting loose and shorting out the battery or even starting a fire.

Connect a short piece of bonding braid across each engine hood hinge. NOTE: The hood will act as a shield to help keep the engine noise inside the engine compartment and away from your antenna. Next connect a short length of bonding braid across each trunk lid hinge, front of the engine to the frame, exhaust tail pipes to the frame, and a piece of wire braid from the air cleaner to the fire wall. It is very important that we caution you to be sure that you clean away all paint, grease or insulation material when installing the grounding braid as **good,** low resistance, ground connections must be made.

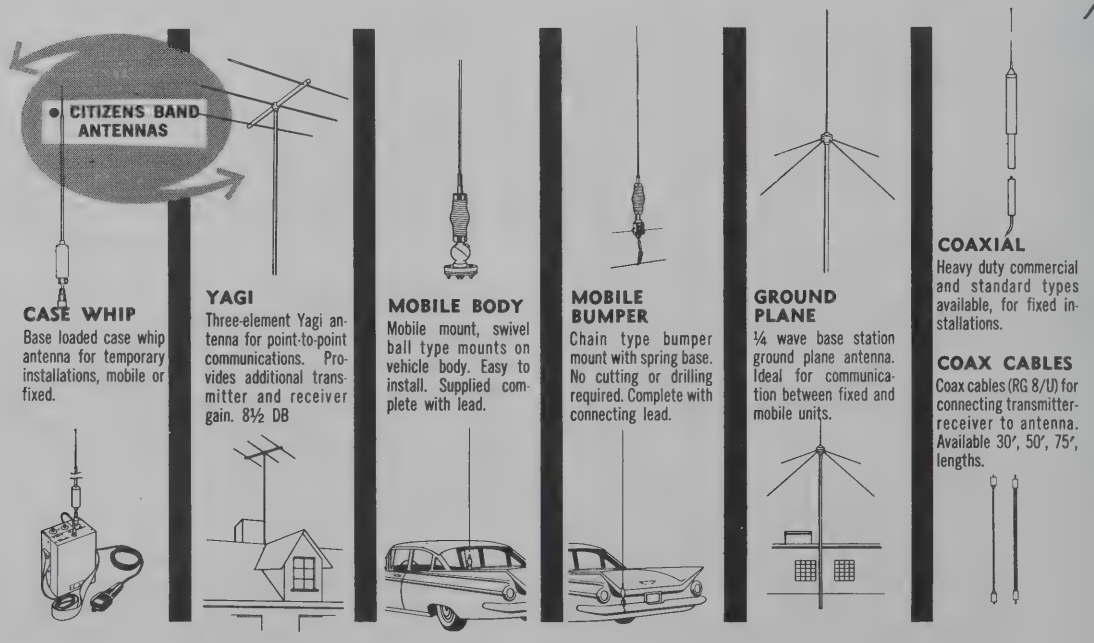
Noisy tires should be treated with an anti-static powder, brake shoes grounded to the backup plates with bonding braid and static collectors installed inside the front wheel grease retainer cups. Heat and oil indicator sending units on the engine must be by-passed with .1 to .5 mfd capacitors, again using very short leads. All instrument panel gauges and accessories should be by-passed using .5 mfd capacitors. Heater and defroster motors, electric windshield wiper motors and any other accessory motors by-passed with a .25 to .5 mfd capacitor. The gasoline sending unit mounted on the gasoline tank must be by-passed with a .1 to .5 mfd capacitor. An inspection plate is usually provided in the trunk compartment over the tank.

For the person who desires the "ultimate" in mobile "noise elimination" there are available for some vehicles marine and aviation spark plugs that could be used and the complete ignition system shielded by using these plugs and making metal boxes to enclose the distributor and coil, and shielding all wiring associated with the ignition system. By having the ignition system **completely** shielded most of the "suppression" can be eliminated and the normal high engine performance will be maintained.

You should set aside a week-end for your "noise elimination" project and have all necessary parts and tools available. You may visit your local two-way radio communications company and secure most of the parts required in kits furnished by some manufacturers of two-way radios. The other parts required are available from radio parts supply and auto parts supply firms.

Lay out your line-of-attack and as each "noise generator" is suppressed it should be noted and checked by listening to the receiver or noting the receiver's "S" meter indication before and after the suppression. This indicates the noise level entering the receiver that is being picked-up by the antenna. To check the noise level entering the receiver by the antenna connecting cable disconnect the cable where it connects to the antenna and short the cable's terminals. If noise is still noticeable it will be necessary to re-route the cable under the vehicle and up through the fire wall to the transceiver. Check the noise level entering the receiver through the power cable by disconnecting the antenna connecting cable at the receiver. All noticeable noise in the receiver is now being picked-up by the power cable and fed to the receiver. This can usually be eliminated by installing a Sprague 48P3 feed-thru coaxial capacitor on the fire wall and the hot battery lead from the transceiver connected through the capacitor to the battery terminal.

We sincerely hope that we have been of some help to you and assure you that when you finish your "noise elimination" project you will consider yourself an "**expert.**" But just as a parting reminder, remember that all of those cars along side of you, up front, behind and the ones passing have not been through the "elimination" process and it will be up to your receiver's built-in noise limiter to cut **their** noises down to a listening level that is bearable.


CITIZENS BAND ANTENNAS
CASE WHIP
Base loaded case whip antenna for temporary installations, mobile or fixed.
YAGI
Three-element Yagi antenna for point-to-point communications. Provides additional transmitter and receiver gain. 8½ DB
MOBILE BODY
Mobile mount, swivel ball type mounts on vehicle body. Easy to install. Supplied complete with lead.
MOBILE BUMPER
Chain type bumper mount with spring base. No cutting or drilling required. Complete with connecting lead.
GROUND PLANE
¼ wave base station ground plane antenna. Ideal for communication between fixed and mobile units.
COAXIAL
Heavy duty commercial and standard types available, for fixed installations.
COAX CABLES
Coax cables (RG 8/U) for connecting transmitter-receiver to antenna. Available 30', 50', 75', lengths.

For further information see your local dealer or write International Crystal Mfg. Co.

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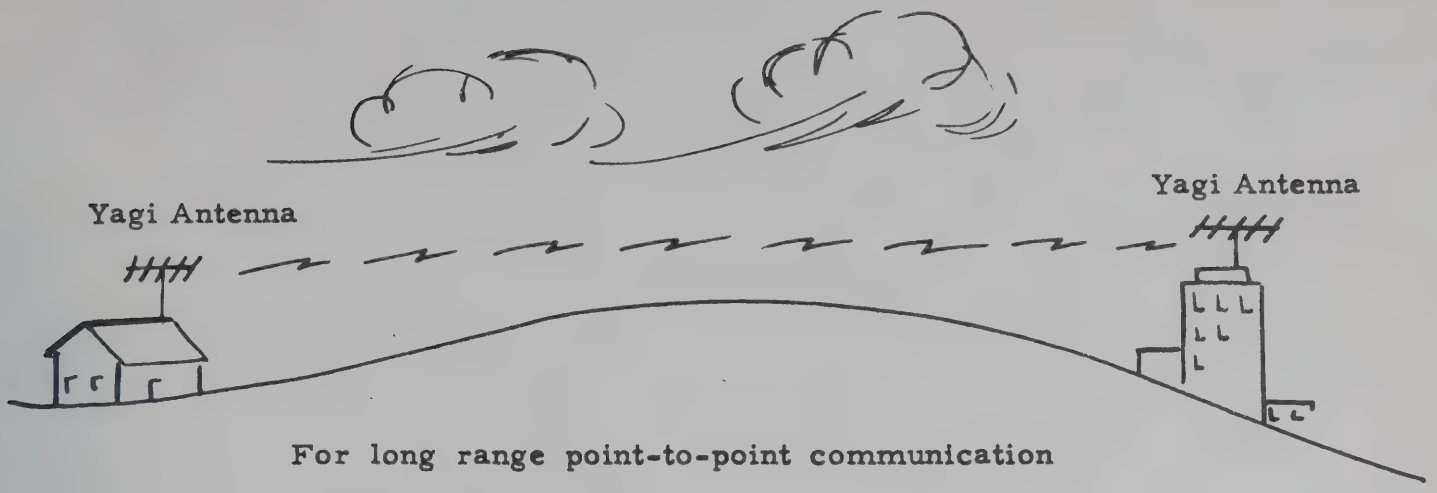
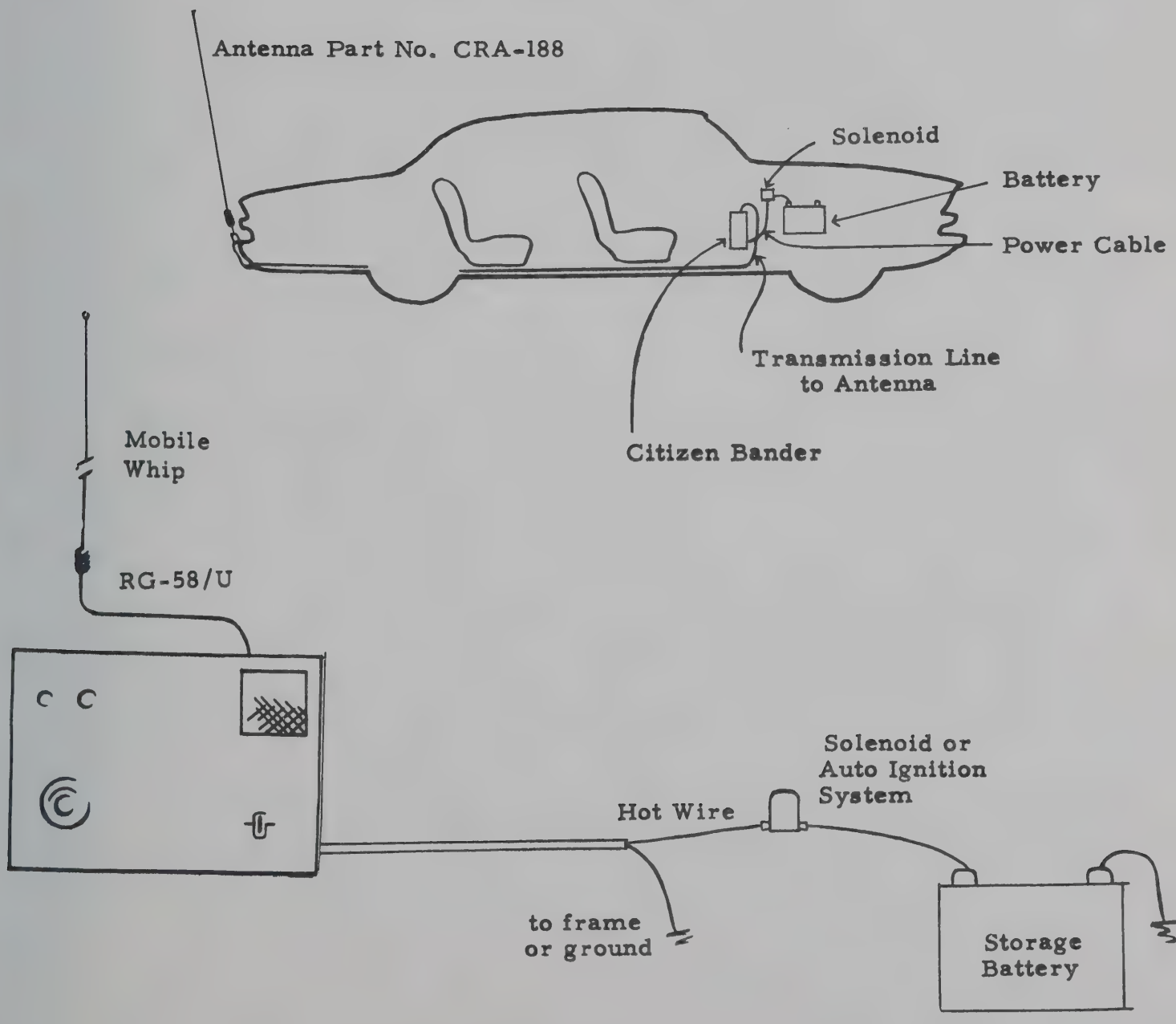


For long range point-to-point communication



Typical Mobile Installation

CAUTION!

Although this unit is equipped with a special connector it is still possible for you to plug the power connecting cable improperly onto this equipment. Serious damage to the unit will occur if this happens. Double check the plug visually before turning the set on.

When this unit is being used in a vehicle the POWER SWITCH should be in the OFF position *before* starting the vehicle's engine. This practice will greatly extend the vibrator life.

WARRANTY

International Crystal Manufacturing Company warrants the parts and tubes in any International Citizen Transceiver to be free from defects in workmanship and material arising from normal usage. Its obligation under this warranty is limited to replacing any such parts or tubes of the receiver which, after regular installation and under normal usage and service, shall be returned within ninety (90) days from the date of original pruchase of the set to the authorized dealer from whom the purchase was made and which shall be found to have been thus defective in accordance with the policies established by International Crystal Manufacturing Company.

The obligation of International Crystal Manufacturing Company is limited to making replacement parts available to the purchaser, and does not include either the making or the furnishing of any labor in connection with the installation of such replacement parts nor does it include responsibility for any transportation expense.

International Crystal Manufacturing Company assumes no liability and shall not be liable in any respect for failure to perform or delay in performing its obligations with respect to the above warranty if such failure or delay results, directly or indirectly, from any preference, priority or allocation order issued by the Government, or because of any other act of the Government, or by war, conditions of war, inadequate transportation facilities, conditions of weather, acts of God, strikes, lockouts, Governmental controls, or Internationls reasonable requirements for manufacturing purposes, or any cause beyond its control or occurring without its fault, whether the same kind or not.

CONDITIONS AND EXCLUSIONS

This warranty is expressly in lieu of all other agreements and warranties, expressed or implied, and International Crystal does not authorize any person to assume for it the obligations contained in this warranty and neither assumes nor authorizes any representative or other person to assume for it any other liability in connection with such International Units or parts or tubes thereof.

The warranty herein extends only to the original consumer purchaser and is not assignable or transferable and shall not apply to any transceiver or parts or tubes thereof which have been repaired or replaced by anyone else other than an authorized International dealer, service contractor or distributor, or which have been subject to alteration, misuse, negligence or accident, or to the parts or tubes of any receiver which have had the serial number or name altered, defaced or removed.

International Crystal Manufacturing Company is under no obligation to extend this warranty to any unit for which an International registration card has not been completed and mailed to the Company within fifteen (15) days after date of purchase.

F.C.C. RULES & REGULATIONS

PART 19.72 POSTING OF STATION LICENSE

(b) The current authorization of each citizens radio station operated as a mobile station or operated at temporary locations may be retained in the permanent records of the station and need not be posted; however, an executed Transmitter Identification Card (FCC Form 452-C, Revised) shall be affixed to each transmitter which is operated as a mobile station or is operated at temporary locations, and to the control equipment of each such transmitter in every case where such transmitter is not in view from the location from which the station is controlled.

(c) The following information shall be entered on each Transmitter Identification Card (FCC Form 452-C, Revised) which is used for transmitter or station identification in accordance with the foregoing:

(1) Name of the station licensee;
(2) Station call sign assigned by the Commission (see 19.62);
(3) Exact location or locations of the permanent station records;
(4) Frequency or frequencies upon which the associated transmitter is adjusted to operate; and
(5) Signature of the licensee.

FEDERAL COMMUNICATIONS COMMISSION
Washington 25, D.C.

87048

April 15, 1960

UNAUTHORIZED PRACTICES IN BUSINESS AND CITIZENS RADIO SERVICES

An increasing number of reports have reached the Commission concerning the practice of some suppliers of Business and Citizens Radio Services equipment to advise their customers that such equipment may be operated by them prior to the issuance of a radio station license by the Commission. In some instances, sellers have "assigned" radio station call signs to purchasers in conjunction with the sale of radio apparatus and, in a few such cases, these call signs have been identical with those authorized to be used by the manufacturer or seller of the equipment.

A radio station license is required for the use or operation of a radio station in the Business and Citizens Radio Services by Section 301 of the Communications Act. With the exception of certain low power equipment described in Part 15 of the Commission's Rules, the operation of any radio transmission apparatus by a person other than the one to whom the Commission has issued a radio station license is illegal and may result in the imposition of severe criminal sanctions (one year in prison or $10,000 fine, or both) or in the institution of other enforcement action by the Commission.

Under Section 310 (b) of the Communications Act, the prior consent of the Commission is required for the transfer or assignment of any radio station license or the rights granted thereunder. One who fails to observe this provision by the purported transfer of his operating authority subjects himself to possible license revocation and such other enforcement action as the Commission may consider warranted by the circumstances. The denomination of such unlawful activities as "equipment demonstrations" does not render them less illicit.

This matter is being brought to the attention of manufacturers, distributors and retail vendors of Business and Citizens Radio Service communication equipment in the belief that they share the Commission's conviction that the orderly development of these dynamic special radio services is hampered by the above-described practices and that one who engages in such practices, in addition to the possibility of having drastic enforcement action instituted against him, may be sacrificing for the benefit of an immediate sale the long range good will of a misadvised customer.

It is requested that the foregoing be brought to the attention of the personnel in all organizations concerned in any way with the sale, maintenance or use of Business or Citizens Radio Stations in order that a prompt cessation of unlicensed operation of radio stations in these services may be brought about.

-FCC-

10-10-50